REMARKS

Applicant's attorney wishes to thank Examiner Wilder for the telephone call of September 4, 2001, in which she confirmed that the Office Action of June 7, 2001, was a final rejection.

Claims 1-16, and 22-38 currently appear in this application. The Office Action of June 7, 2001, has been carefully studied. It is believed that all of the claims are allowable, and favorable action is earnestly requested.

Specification

A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required.

Submitted herewith is a substitute specification. No new matter is contained in this substitute specification.

Rejections under 35 U.S.C. 112

Claims 1-16 and 22-25 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains to make and/or use the invention, wherein the substrate has a thermal conductivity ratio equal to or more than 0.1 W/cm°K.

This rejection is respectfully traversed. The claims have been amended to recite the specific thermal conductivity ratios required. One skilled in the art, without

undue experimentation, should readily be able to obtain a thermal conductivity ratio for a given material.

Claims 1-16 and 21-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

This rejection is respectfully traversed. The claims have been amended in accordance with the Examiner's helpful suggestions. It is believed that all of the claims now conform to the requirements of 35 U.S.C. 112.

Art Rejections

Claims 1-5, 9-11 13-16 and 25 are rejected under 35 U.S.C. 102(e) as being anticipated by Chrisey et al.

This rejection is respectfully traversed. Attention is directed to Table 1.

Table 1 Difference between the present invention and cited patent (U.S. Patent No.5,688,642)

	The present invention	cited patent (U.S. Patent No.:5,688,642)
Substrate	diamond, silver, copper, ceramic, etc.	silicon, glass, diamond, quartz, alumina, etc.
Process of Chemical modification	First method; ① chloridizing a surface of the substrate by irradiating ultraviolet radiation in chloride gas ② reacting with carboxylic soda in nonaqueous solvent ③ neutralizing the substrate weak acid solvent Second method; ① oxidizing a surface of the substrate with oxygen plasma ② chloridizing and hydrolyzing in alkali solution ③ reacting with carbonic chloride in nonaqueous solvent	First method; ① coating with organosilane ② reacting said organosilane with heterobifunctional crosslinker. ③ defining : surface has a first pattern including organosilane molecules and a second pattern including that lacks organosilane molecules ④ exposing said patterned surface ⑤ removing non-specifically adsorbed pre-formed synthetic nucleic acid oligomers from said patterned surface Second method; ① coating with non-DNA-binding organosilane ② defining : surface has a first pattern including non-DNA-binding organosilane molecules and a second pattern including that non-DNA-binding organosilane molecules removed ③ binding nucleic acid-binding organosilane molecules at said second region. ④ reacting said organosilane with heterobifunctional crosslinker. ④ exposing said patterned surface ⑤ removing non-specifically adsorbed pre-formed synthetic nucleic acid oligomers from said patterned surface

While the substrate of Chrisey et al. is similar to that of the present invention, the process of chemical modification of the substrate is different. Chrisey et al. modify by means such as electrodeposition, and UV crosslinking. There is nothing in Chrisey et al. that

discloses or suggests the use of chemical modification by binding a chloride or a hydroxyl radical to the substrate as claimed herein. The present invention, on the other hand, introduces a hydroxyl radical to the surface of the substrate, after which the surface of the substrate is treated with a carboxylic acid, such as malonic acid. The surface of the substrate thus has a carboxyl radical at terminal. After the surface of the substrate is chemically modified as claimed herein, the substrate is treated by reaction for amplifying DNA, wherein a predetermined amount of DNA is obtained on the substrate.

Chrisey et al. on the other hand, relates to a method for coating a substrate with an organosilane in order to bind the nucleic acid onto the substrate. There is no hydroxyl radical on the Chrisey et al. substrate, unlike in the present invention.

Chrisey et al. teach that when the substrate has a polar radical at terminal, the polar radical is connected to the surface of the substrate with a silane coupling agent or through an ester linkage. There is nothing in Chrisey et al. that discloses or suggests that a polar radical, which can be a carboxyl radical, is connected to the surface of a substrate through an ester or amide linkage, or wherein the carboxyl radical is connected to the surface of the substrate with a silane coupling agent, a titanium coupling agent, or an

aluminum coupling agent. Contrary to the Examiner's assertion that the Chrisey et al. substrate is chemically modified at terminal with carboxyl radical, it should be noted that the second nucleic acid is affixed covalently through a 5' linkage and the carboxylated functional group of the latex bead and nucleic acid is not affixed through the carboxyl radical at the terminal.

Claims 6-8 and 22-24 are rejected under 35 U.S.C. 1039(a) as being unpatentable over Chrisey et al. in view of Adams et al. and further in view of Weetall et al. The Examiner alleges that Chrisey et al. teach a substrate for DNA immobilization which has substantial thermal conductivity, and wherein a polar radical is bound to the substrate to promote immobilization of a nucleic acid to the surface of the substrate. Adams et al. are said to teach a method for amplifying DNA comprising immobilizing DNA on a solid substrate wherein the substrate is chemically modified at a terminal with a carboxyl radical. Weetall et al. are said to teach a solid substrate having a polar radical at terminal wherein the polar radical is epoxy, amine, carboxyl or hydroxyl, and wherein the polar radical is attached to the surface of the substrate with a silane coupling reagent

This rejection is respectfully traversed. As noted above, there is absolutely nothing in Chrisey et al. that would lead one skilled in the art to treat a substrate by

chloridization, hydroxylation, etc. as in the present invention. Adams et al. add nothing to this disclosure, because there is nothing in Adams et al. that even suggests treating the substrate as in the present invention. Weetall et al. also add nothing to the Chrisey et al. disclosure, as Weetall et al. couple the DNA through a silane coupling agent previously attached to the glass surface. As in Example 1A of Weetall et al., there is no chloridization, etc. of the substrate. Moreover, Weetall et al. use glass substrates, and glass is well known to be a poor thermal conductor.

Claim 12 is rejected under 35 U.S.C.103(a) as being unpatentable over Adams et al. The Examiner states that Adams et al. teach a method for amplifying DNA for a substrate using the PCR.

This rejection is respectfully traversed. In the present invention, the silane coupling agent is applied to the surface of a substrate which has a polar radical thereon. However, in Adams et al., the silane coupling agent is applied directly to the surface of the substrate, with no polar radical on the substrate. The criticality of the present invention is not the PCR itself, but the use of a substrate which has been treated to contain hydroxyl or other polar radicals which are then used to attach a coupling agent to a substrate.

In view of the above, it is respectfully submitted

that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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1. (Twice Amended) Solid state substrate for DNA ~~immobilizing~~ immobilization, said solid state substrate having ~~substantial~~ a thermal conductivity ratio of at least 0.1W/cm°K for amplifying and immobilizing DNA.

2. (Amended) ~~Substrate~~ A substrate as claimed in claim 1, wherein said substrate is natural diamond or synthetic diamond.

3. (Twice Amended) ~~Substrate~~ The substrate as claimed in claim 2, wherein said substrate is chemically modified.

4. (Twice Amended) ~~Substrate~~ The substrate as claimed in claim 3, wherein said substrate has a polar radical at a terminal on the surface of the substrate.

5. (Twice Amended) ~~Substrate~~ The substrate as claimed in claim 4, wherein said polar radical is hydroxyl radical, carboxyl radical, epoxy radical or amino radical.

6. (Amended) ~~Substrate~~ The substrate as claimed in claim 5, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate

through ester linkage.

7. (Amended) ~~Substrate~~ The substrate as claimed in claim 5, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate through amide linkage.

8. (Amended) ~~Substrate~~ The substrate as claimed in claim 5, wherein said polar radical is a carboxyl radical and said carboxyl radical is introduced to a surface of said substrate with ~~cylane~~ a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

9. (Amended) ~~Substrate~~ The substrate as claimed in claim 5, wherein said polar radical is an epoxy radical and said epoxy radical is introduced to a surface of said substrate with ~~cylane~~ a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

10. (Amended) ~~Substrate~~ The substrate as claimed in claim 5, wherein said polar radical is an amino radical and said amino radical is introduced to a surface of said substrate with ~~cylane~~ a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

11. (Amended) ~~Chip~~ A chip for immobilizing DNA as claimed in claim 1, wherein DNA is immobilized ~~on~~ to said substrate.

12. (Twice Amended) A method for amplifying DNA for a substrate or chip, comprising the following steps:

(a) chemically modifying the substrate or chip to provide a polar radical selected from the group consisting of hydroxyl radical, carboxyl radical, epoxy radical, amino radical, sulfuric radical, cyano radical, nitro radical, and thio radical on the surface of the substrate or chip;

(b) cleaning the chemically modified substrate or chip with ~~TE~~ Tris-EDTA buffer solution;

(c) dipping the chemically modified and cleaned substrate or chip ~~in~~ into a solution containing a primer ~~with respect to~~ of amplifying target DNA, four kinds of ~~nucleotide~~ nucleotides and DNA ~~polymerize~~ polymerase;

(d) holding the temperature of said solution at 95°C for about 1.5 minutes;

(e) holding the temperature of said solution at 45°C for about a minute;

(f) holding the temperature of said solution at 74°C for about 2 minutes; and

(g) repeating ~~the~~ steps (d)-(f).

14. (Twice Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 13, wherein said substrate has a polar radical at a terminal on the surface of the substrate.

15. (Twice Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 14, wherein said polar radical is hydroxyl radical, carboxyl radical, epoxy radical or amino radical.

16. (Amended) ~~Chip~~ A chip for amplifying and immobilizing DNA ~~as claimed in claim 15, wherein DNA is immobilized on said substrate~~.

22. (Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 15, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate through an ester linkage.

23. (Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 15, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate through an amide

linkage.

24. (Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 15, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected to a surface of said substrate with a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

25. (Amended) ~~Substrate~~ The substrate having DNA immobilized thereon as claimed in claim 15, wherein said polar radical is an epoxy radical or an amino radical and said epoxy radical or said amino radical is connected to a surface of said substrate with a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.